

High School Physics: 1D Kinematics & Motion Graph Analysis



Name: _____ Date: _____

Part A: Kinematics Calculations. Solve each mechanical physics problem below using constant acceleration equations.

1. A high-speed train accelerates uniformly from rest ($v_0 = 0 \text{ m/s}$) at a rate of 2.5 m/s^2 for 10 seconds. What is the train's final velocity v_f and total displacement Δx over this interval?

- A. $v_f = 25 \text{ m/s}$; $\Delta x = 125 \text{ meters}$
- B. $v_f = 25 \text{ m/s}$; $\Delta x = 250 \text{ meters}$
- C. $v_f = 50 \text{ m/s}$; $\Delta x = 125 \text{ meters}$
- D. $v_f = 12.5 \text{ m/s}$; $\Delta x = 62.5 \text{ meters}$

2. On a Velocity vs. Time (v-t) graph, what physical quantity is represented by the SLOPE of the line, and what is represented by the AREA under the line?

- A. Slope = Jerk; Area = Kinetic energy
- B. Slope = Acceleration; Area = Displacement (change in position)
- C. Slope = Momentum; Area = Force
- D. Slope = Position; Area = Acceleration

3. A rock is dropped from rest off the edge of a cliff. Neglecting air resistance, what is the rock's velocity after falling freely for 3.0 seconds (taking downward $g = 9.8 \text{ m/s}^2$)?

- A. 14.7 m/s downward
- B. 29.4 m/s downward
- C. 44.1 m/s downward
- D. 9.8 m/s downward

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Part B: Motion Graph Interpretation Matrix. Identify the motion characteristics corresponding to each graph type.

Sort these items: Horizontal flat line indicates object is stationary at rest (velocity = 0); Horizontal flat line above the axis indicates constant, unchanging velocity (zero acceleration); Non-zero constant horizontal line indicates uniform acceleration (parabolic position graph); Parabolic curve indicates changing velocity (active acceleration); Linear slope represents acceleration; crossing the horizontal axis indicates change in direction; Area under curve represents change in velocity (Δv) over the specified time interval

Position vs Time (x-t)	Velocity vs Time (v-t)	Acceleration vs Time (a-t)